Two boaters leave Ludington, Michigan, at 8:00 A.M. One is going to Manitowoc, Wisconsin, at a direction of 150°. The other heads for Milwaukee at a direction of 200°. Manitowoc is about 70 miles from Ludington; Milwaukee is about 107 miles. The radios on the boats are good for distances up to 60 miles.

a. With Ludington as the origin, set up a coordinate system. What are the coordinates of Manitowoc and Milwaukee?

man = $\langle 70\cos 150, 70\sin 150\rangle$

$\langle -60.6, 35\rangle$

M:l = $\langle 107\cos 200, 107\sin 200\rangle$

$\langle -100.55, -36.59\rangle$

b. Sketch a vector diagram if the boat to Manitowoc travels at 10 mph and the boat to Milwaukee travels at 12 mph.

How far from each other are the boats at 9:00 A.M.? At 11:00 A.M.?

man = $x = 10\cos 150t = -8.66t$ m:l $x = 12\cos 200t = -11.28t$

$y = 10\sin 150t = 5t$ $y = 12\sin 200t = -4.1t$

c. At about what time will they lose radio contact?

2:21 pm

$D = rt$

$60 = 9.448t$

$\frac{60}{9.448} = 6.35$

$(.35)(60)$ 21

d. How far from their destinations are the boats when they lose radio contact?

$t = 6.35$

min

$x = -8.66(6.35)$

$y = 5(6.35)$

$\langle -54.991, 31.75\rangle$

mag

m:l

$x = -11.28(6.35)$

$y = -4.1(6.35)$

$\langle -71.628, -26.035\rangle$

mag

$\langle -71.628-(-54.991), -26.035-31.75\rangle$

$\langle -16.637, -57.785\rangle$

70 - mag

70 - 63.499

6.5

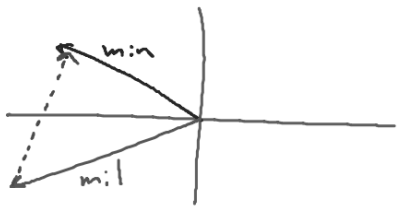
107 - mag

107 - 76.21

30.79

b) $t=1$ (9:00am)

min $\langle -8.66, 5 \rangle$ mil $\langle -11.2, -4.1 \rangle$



mil − min

$\langle -11.2-(-8.66), -4.1-5 \rangle$

$\langle -2.54, -9.1 \rangle$

mag $= \sqrt{(-2.54)^2+(-9.1)^2} = 9.448$ miles

$t=3$ (11:00am)

man $= \langle -25.98, 15 \rangle$

mil $= \langle -33.6, -12.3 \rangle$

$\langle -33.6-(-25.98), -12.3-15 \rangle$

$\langle -7.62, -27.3 \rangle$

$\sqrt{(-7.62)^2+(-27.3)^2} = 28.344$ mi